

Massachusetts Institute of Technology
Instrumentation Laboratory
Cambridge, Massachusetts

LUMINARY Memo #30

To: Distribution
From: J. Kernan, C. Schulenberg
Date: 7 June 1968
Subject: LUMINARY Level 4 Test Plan

Attached is an outline of the 30 LUMINARY Level 4 tests. Suggestions from NASA, 23C and 23A have been incorporated into the test sequences.

The tests are not duplicates of DANCE Level 4's. Emphasis has been placed on lunar environment testing (3 are Earth; 1 is Cislunar). Nine are scheduled for the Hybrid.

V67 (W-Matrix display) is included although it is as yet unapproved.

An Earth launch time of 1500 Hours, March 16, 1969 will be used. Initialization data will be generated by 23A from Mission G trajectories.

L4.1 Separation Test (Lunar-Hybrid)

Initialize with old state vectors.

P00 Mode select off
V96 Stop integration
R33
P27 Uplink state vectors
P00 Integrate
P27 Uplink REFSMMAT, set Preferred Attitude flag and
Refsmmat flag with N07
R03
P52 Align to Preferred Attitude (CSM Refsmmat)
P00 R47
P47 Manual Separate 1 fps
P20 Track Mode (V95), R31

L4.2 Return to Earth Abort (Lunar-Digital)

P00 R03, R04
P30 Target for TEI
P52 Align to Refsmmat, R47
P40

L4.3 Descent Orbit Injection (Lunar-Hybrid)

P00 R03
P52 Align to Landing Site
P30 Target for DOI, R47
P40 At TIG +15 throttle up to 40% manually
R30
P25

L4. 4 Powered Descent with Early Abort (Lunar-Digital)

P00 R03, R05
P20 V95, R47
P63 R51
Abort at TIG +30
P70
P40 Null VG, R31

L4. 5 Powered Descent (Lunar-Hybrid)

P00 R03
P63 R29, R10, Manual Yaw Up, R12, V58
P64
P65
P67
P66 ROD to Hover
P67 To touchdown, wait 3 minutes
P12 To TIG -5, terminate, Mode Select off
P57 Option 0

A downlink edit of the entire descent profile will be performed in this run.

L4. 6 Abort from Touchdown (Hybrid)

P00 R03
P63 R29, R10, Manual Yaw up, R12, V58⁵⁷
P64
P65 To touchdown, V58^g, wait 2 min.
Abort Stage
P71 Null VG
P25 R30, R31

L4.7 Abort from Late Descent (Digital)

P00

P63 R29, R10, Manual Yaw up, R12, V58

P64

V37E 70E to fuel depletion

Abort stage

P71 to cutoff in 30 n. mi. orbit

R30 R31

L4.8 Lunar Surface Navigation (Digital)

P00 Mode Select off

P57 Option 1

P21 for CSM

P22 Option 1 Horizon to Horizon with R31

P00 R05

A downlink edit of P22 will be performed.

L4.9 Lunar Surface Navigation (Digital)

P00 Mode Select off

P57 Option 2

R32 Change CSM orbit to contain Landing Site at launch time

P22 Option 2

P00

L4.10 Lunar Launch (Digital)

P00 R03, Mode Select off
P57 Option 3
P21 for CSM
P12 Start when CSM at Horizon, R47, R29
Null VG
R30 R31
P00

A downlink edit of the Ascent will be performed.

L4.11 CSI-CDH Sequence (Lunar-Digital)

P00 R03, R47
P20 Take marks R31
P32 R36, V06N52
P42 R30, Null VG
P20 Take marks
P33 R36, V06N52
P42 R31, Null VG
P00 V67

L4.12 CDH-TPI Sequence (Lunar-Digital)

P00 R03
P20 Take marks R31
P33 R36, V06N52
P42 Null Vg, R30
P20 Take marks
P34 R36, V06N52
P42 R31
P00 V67

L4.13 TPI-TPM Sequence (Lunar-Digital)

P00	R03
P20	Take marks, R31
P34	R36, V06N52
P42	R31
P20	Take marks
P35	R36, V06N52
P41	R30
P00	V67

L4.14 SOI-SOM Sequence (Lunar-Digital)

P00	R03
P20	R31, take marks, V67
P38	(Mode 1), V06N52
P42	R30
P20	Take marks
P39	
P41	R31
P00	R63 Z-axis

L4. 15 SOI-SOM-SOR Sequence (Lunar-Digital)

P00 R03
P20 Take marks
P38 (Mode 1)
P40
P20 Take marks
P39
P41
P20 Take marks
P38 (Mode 2)
P40

L4. 16 CSM Active CSI-CDH Sequence (Lunar-Digital)

P00 R03
P25
P72 R32 (V80, V81), V06N52
P73 R32, R31, V06N52
P21

L4. 17 CSM Active CDH-TPI Sequence (Lunar-Digital)

P00 R03
P25
P73 R32, V06N52
P74 R36, R32, V06N52
P00

L4. 18 CSM Active TPI-TPM Sequence (Lunar-Digital)

P00	R03
P25	
P74	R36, R32, V06N52
P75	R32, V06N52
P00	V33

L4. 19 CSM Active SOI-SOM Sequence (Lunar-Digital)

P00	R03
P20	V81 take marks
P78	(Mode 1) V06N52
R32	
P20	V81 take marks
P79	

L4. 20 CSM Active SOI-SOM-SOR Sequence (Lunar-Digital)

P00	R03
P25	
P78	(Mode 1)
R32	
P79	
R32	
P78	(Mode 2)
R32	
P21	

L4. 21 CSM Docked Midcourse (Cislunar-Digital)

P00 R03, R05
P27 Uplink Lambert target for long burn
P31
P40

L4. 22 CSM Docked - IMU Align (Lunar-Digital)

P00 R03
IMU off
P06 Wait 5 min.
LGC on wait 1 min.
IMU on
P51
P00 R05

L4. 23 SOR With IMU Off (Earth-Hybrid)

P00 R03
IMU off
P38 R36, V06N52
IMU on
P51
P41 V83
P00 R63 - X axis

L4. 24 SOM With IMU Align (Earth-Hybrid)

P00	R03
P39	V06N52
P52	Nominal
P42	V83
P00	R63 - Z axis, R05

L4. 25 External Delta V with CSM Update (Lunar-Hybrid)

P00	R03
P20	V95
P30	
P00	R62
P42	V82, Null Vg
P20	V81, V83 take marks
P00	V67

L4. 26 External Delta V with Manual Acquire (Lunar-Digital)

P00	R03
R32	
P20	R23, V81 take marks
P30	
P00	R62, V67
P41	V82
P20	V83

L4. 27 CSM Active CSI with RR Search (Lunar-Hybrid)

P00	R03
P25	
P20	R24
R32	
P20	V81
P72	R36
P20	V67

L4. 28 TPI-TPM Sequence (Earth-Hybrid)

P00	R03
P20	Take marks
P34	
P42	
P20	V67 Load W-Matrix Initialization, take marks
P35	
P41	R30
P21	

L4. 29 Lunar Surface Navigation (Digital)

P00	Mode Select off
P21	CSM option with CSM beyond horizon
P22	Option 2 V95
P21	For CSM, V82 for CSM
P22	Option 1, V67-Initialize W-Matrix
V83	

L4. 30 Lunar Surface Navigation with RR Search (Digital)

P00 Mode select off

R32 For CSM

P22 Option 1 R24

V67 Initialize W-Matrix

Take marks until LOS broken

P21 until CSM beyond horizon